User Manual

COREPLAYER & CORELIBRARY

- System requirements
- CorePlayer installation
- CoreLibrary description

WORKSWELL

General system requirements

Minimal requirements

Processor:	Intel Core 2 Duo or equivalent
Memory (RAM):	1 GB
HDD:	At least 100 MB available hard disk space.
NIC:	1000 Mb/s, Jumbo frame 9kb.
OS:	Windows 7

Recommended configuration

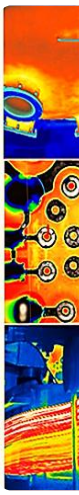
Processor:	Intel Core i3
Memory (RAM):	4 GB
HDD:	1 GB available hard disk space
NIC:	Gigabit Ethernet adapter and also a Gigabit Ethernet switch could be used for connecting more devices

In order to acquire images from a GigE Vision camera, you need to first make sure that you have all the correct hardware components and proper configuration. Below is a list of requirements.

Special hardware requirements

GigE Vision camera: The camera must be GigE Vision standard compliant. If you have a camera that has a Gigabit Ethernet port but is not GigE Vision compliant, you cannot acquire images using CorePlayer. You should find the GigE Vision logo in the camera's user manual or marketing literature.

Gigabit Ethernet port: While it is possible to acquire images with Ethernet and Fast Ethernet ports, which support 10 MB/s and 100 MB/s respectively, this will only work at very slow frame rates and small resolutions. It is highly recommended that you use a Gigabit Ethernet Network Interface Controller (NIC).



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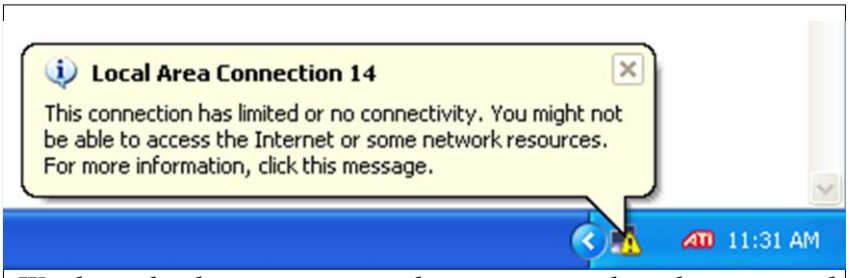
Network configuration

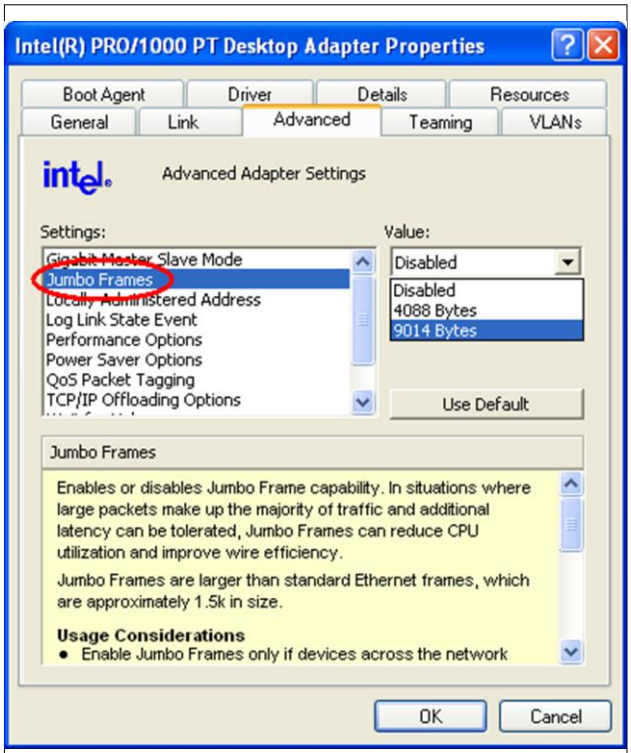
Once you have the hardware and software installed correctly, you must configure the network as well. GigE Vision cameras can obtain an IP address from a DHCP server or select one for itself using Link Local Addressing (LLA). If you connect the camera to a Gigabit Ethernet network with a DHCP server, the camera is automatically detected. If the camera is connected directly to the computer (using either a regular or cross-over cable), maybe you will need to wait about a minute for the camera to timeout on the DHCP request and use LLA. The Windows operating system may display a warning that the network card has only limited operation. You can ignore this warning.


Local Area Connection 14
This connection has limited or no connectivity. You might not be able to access the Internet or some network resources.
For more information, click this message.
11:31 AM

Windows displays a warning when camera is directly connected

Jumbo packets

Typically, network drivers will split any data larger than 1500 bytes into multiple packets. However, the GigE Vision standard allows packet sizes of up to 9014 bytes. These large packets, also known as Jumbo packets, allow the camera to more efficiently transfer data across the network. You can enable Jumbo packets in many network cards from the Device Manager by right-clicking the network card and selecting Properties.



Setting Jumbo packets on the Intel PRO/1000 Adapter

Network Firewalls

When a camera acquires an image, it immediately streams those data packets to the host. However, network firewalls will not allow the packets to reach their destination because firewalls typically block uninitiated incoming traffic. Therefore you will need to disable you firewall in order to acquire images from a GigE Vision camera. You can disable the Windows Firewall from the Control Panel (Start>>Control Panel). However if you have a network card with an Intel PRO/1000 chipset and you are using the Filter driver that comes with CorePlayer, it is most likely that you will not need disable the firewall.

Notifications and difficulties

Jumbo Packets: If your NIC device, or any intermediate network hardware (switch, router, etc.), does not support Jumbo packets, you will be limited to a packet size of less than 1500 Bytes. The GigE Vision packet size cannot be greater than the maximum packet size allowed by the NIC.

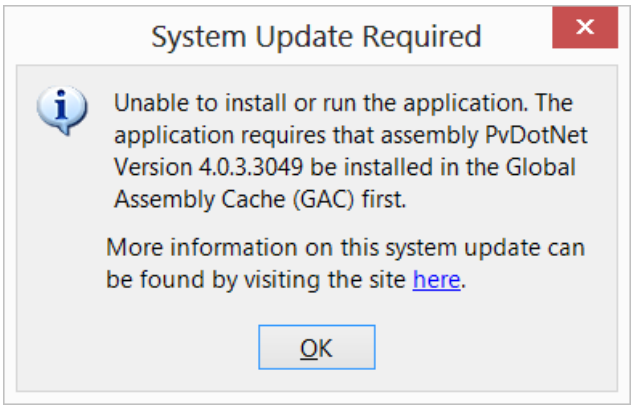
Firewalls: Many corporate networks employ firewalls for network security. However, you cannot acquire from GigE Vision cameras with the firewall enabled, unless you use the High Performace driver.

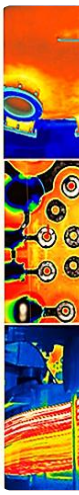
If your company's network policy does not allow you to disable the firewall or use a different network driver, you will need to use a system dedicated to image acquisition, that is not part of the corporate network.

Corrupt XML files: As with any new standard, camera manufacturing companies routinely release new revision of their firmware. If you get an error stating that the XML file is corrupt, please contact the camera manufacturer for the latest revision of their firmware.

Interoperability: While GenICam gives camera manufacturers the flexibility of creating a custom attribute set, it makes it difficult to easily switch between cameras without modifying your code. While the GenICam Standard Features Naming Convention alleviates this problem to a certain extent, most of the conventions are only recommendations and not requirements. So a camera manufacturer may deviate from the convention, in which case, the application software will need to be modified to be interoperable with other

eBUS installation: While is shown information windows mentioned below, there is problem with old version of eBUS SDK. For this case you need to remove older version of your eBUS SDK, restart PC and launch ThermoConnetor installation again.

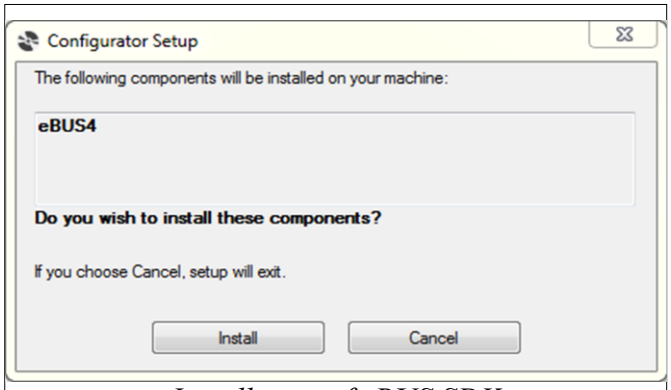

System Update Required
Unable to install or run the application. The application requires that assembly PvDotNet Version 4.0.3.3049 be installed in the Global Assembly Cache (GAC) first.
More information on this system update can be found by visiting the site here.
OK



Installing CorePlayer

Setup

To get your copy of Workswell CorePlayer, go to page www.workswell.cz/CorePlayer/beta/publish.htm and click on Install. Then proceed to the folder where you've downloaded the setup program and open it. If you see a prompt asking whether to install eBUS SDK or not, click on *Install*, otherwise the setup program would quit.

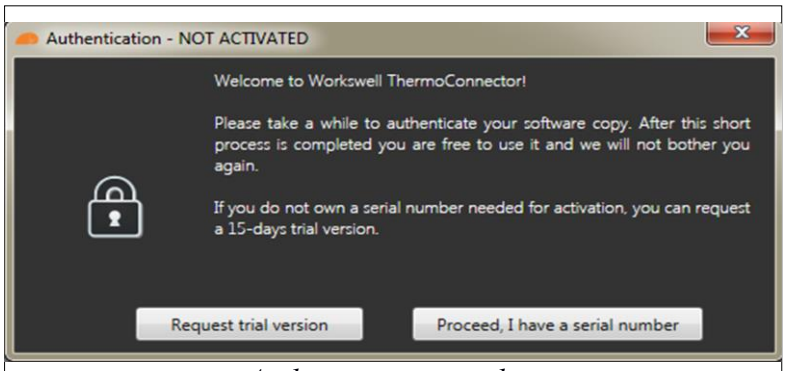

Configurator Setup
The following components will be installed on your machine:
eBUS4
Do you wish to install these components?
If you choose Cancel, setup will exit.
Install
Cancel

Installation of eBUS SDK

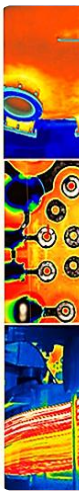
Follow the instructions of the eBUS SDK Setup program and in the end, if asked, reboot your computer. The installation will then continue. If not, please run the setup program again. CorePlayer's setup program itself doesn't need any further user interaction and the service application will run immediately as soon as the installation is completed.

Activation

When you run the program for the very first time, the Authentication window is the first thing to deal with. The Authentication window provides you with two options: If you don't have a serial number and want to evaluate the software for a limited period of 15 days, choose *Request trial version*, otherwise, if you have valid, not yet activated serial number, click the *Proceed, I have a serial number* option.


Authentication - NOT ACTIVATED
Welcome to Workswell ThermoConnector!
Please take a while to authenticate your software copy. After this short process is completed you are free to use it and we will not bother you again.
If you do not own a serial number needed for activation, you can request a 15-days trial version.
Request trial version
Proceed, I have a serial number

Authentication window



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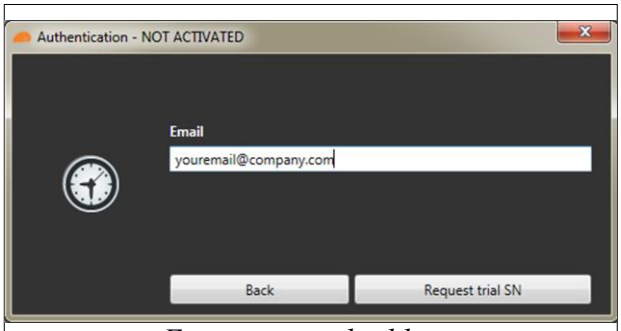
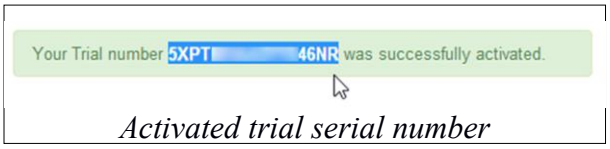
Trial version

When requesting a trial version of Workswell CorePlayer, all you have to do is enter your (valid) email address.



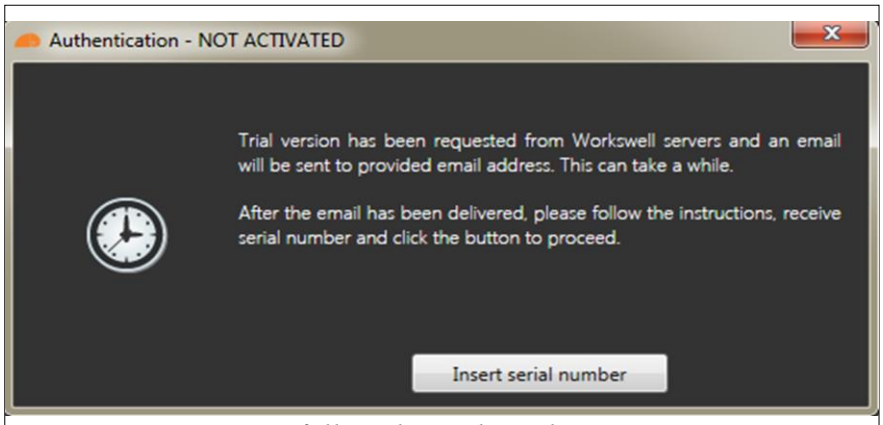
Entering email address

In a matter of seconds, you will recieve an email with activation link leading to Workswell Activation Server, where we would be glad if you took a moment to fill in a brief info about yourself and helped us to improve the software to better suit the needs of our customers. After you'll express consent with the Licensing terms and agree to the above terms, click Activate and you will be given a unique trial serial number, valid for 15 days.

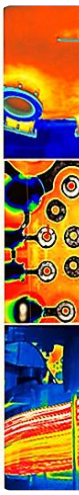


Activated trial serial number

Copy the number. Then return to the program and click *Insert serial number.*


Authentication - NOT ACTIVATED
Trial version has been requested from Workswell servers and an email will be sent to provided email address. This can take a while.
After the email has been delivered, please follow the instructions, receive serial number and click the button to proceed.
Insert serial number

Successfull trial serial number request



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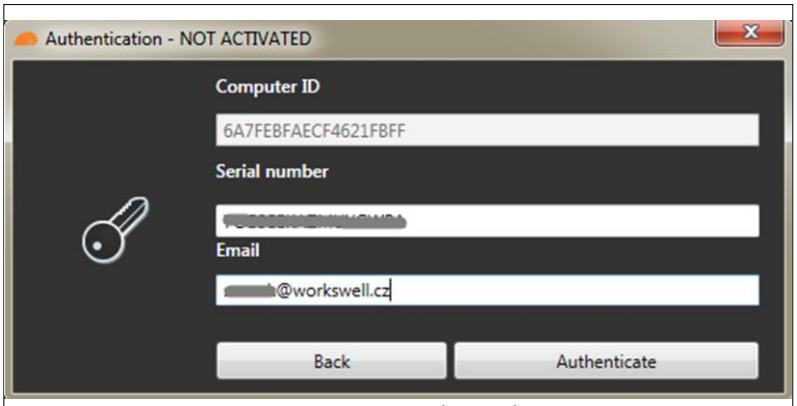
Further steps are the same as if you had a licensed copy of Workswell CorePlayer, and are described in next section.

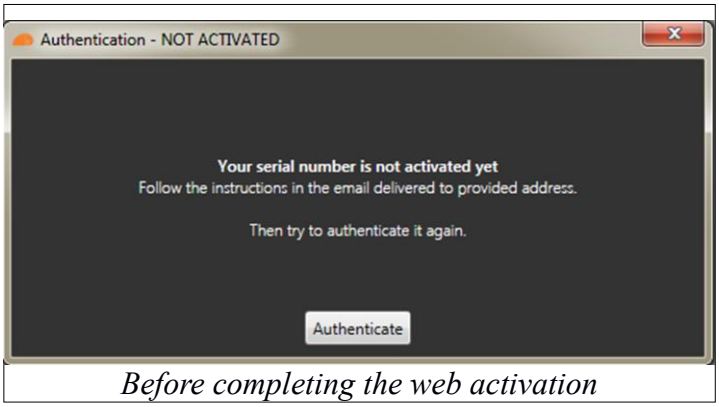
Full version

If you have a full version of the program (or you already have activated trial serial number), start the activation process by clicking on *Proceed, I have a serial number* button. On the next screen, enter your serial number provided by your sales partner or by Workswell and fill in a valid email address of yours. Click the *Authenticate* button.



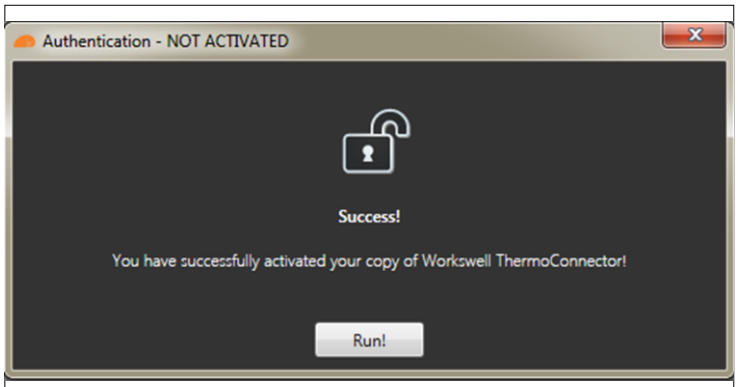
Inserting serial number

Next steps apply for full versions only The Authentication window is now indicating that your serial number is not yet activated. Never mind, everything has been taken care of.


Authentication - NOT ACTIVATED
Your serial number is not activated yet
Follow the instructions in the email delivered to provided address.
Then try to authenticate it again.
Authenticate

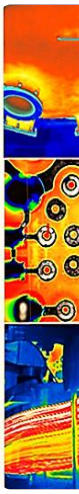
Before completing the web activation

By clicking *Authenticate* on the previous screen, you've send an activation request to Workswell Activation Server and as a response, you will receive email with activation link. Click it and fill in a brief info about yourself. After you'll express consent with the Licensing terms and conditions by checking the I agree to the above terms, click *Activate* and return to the program. Click *Authenticate* as seen on the image above.



Successful activation

Click *Run!* and you are free to use Workswell CorePlayer.



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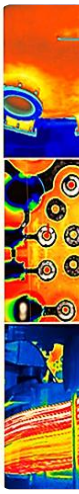
Supported Cameras

CorePlayer was designed especially for Flir Tau2 cameras, but there is basic support for other types.

- **Flir Tau2**
  - **Fully supported** and tested.
  - Configurable device setup with intuitive graphic user interface.
  - Temperature calculation.
- **Flir Ax5 & Ax15**
  - Partially supported
  - Configurable through common GenICam setup
  - Temperature calculation.
- **Generic GenICam camera**
  - Common GenICam setup
  - 8bit video output only (grayscale/palette).



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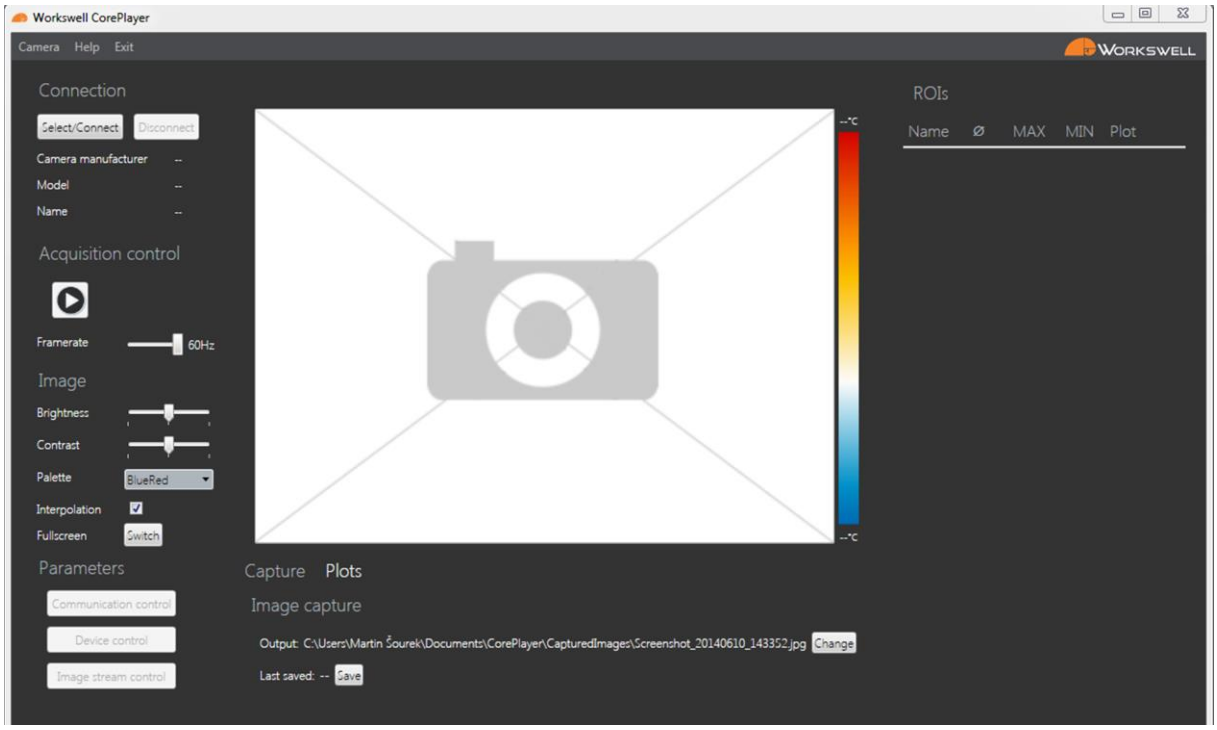
CorePlayer software

Run application

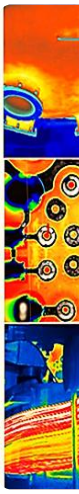
The application will be started immediately after successful installation.

Otherwise, you can run it by clicking on desktop icon, or similar one in Start menu (Workswell → CorePlayer → CorePlayer).

Following application window will be shown.

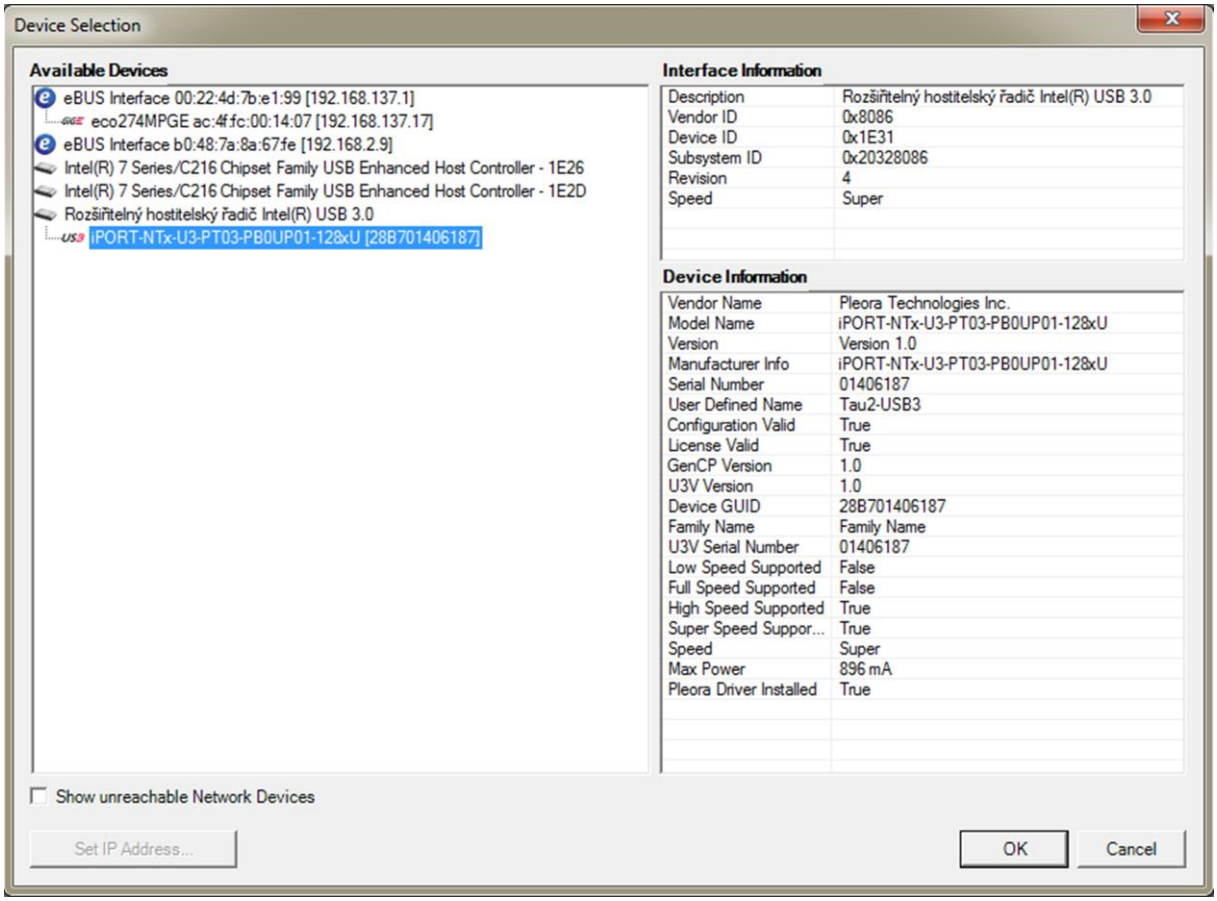


Main application window - no camera connected



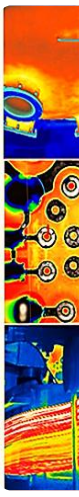
Connection

Click Select/Connect to choose camera device which you want to connect. Following dialog will be shown.



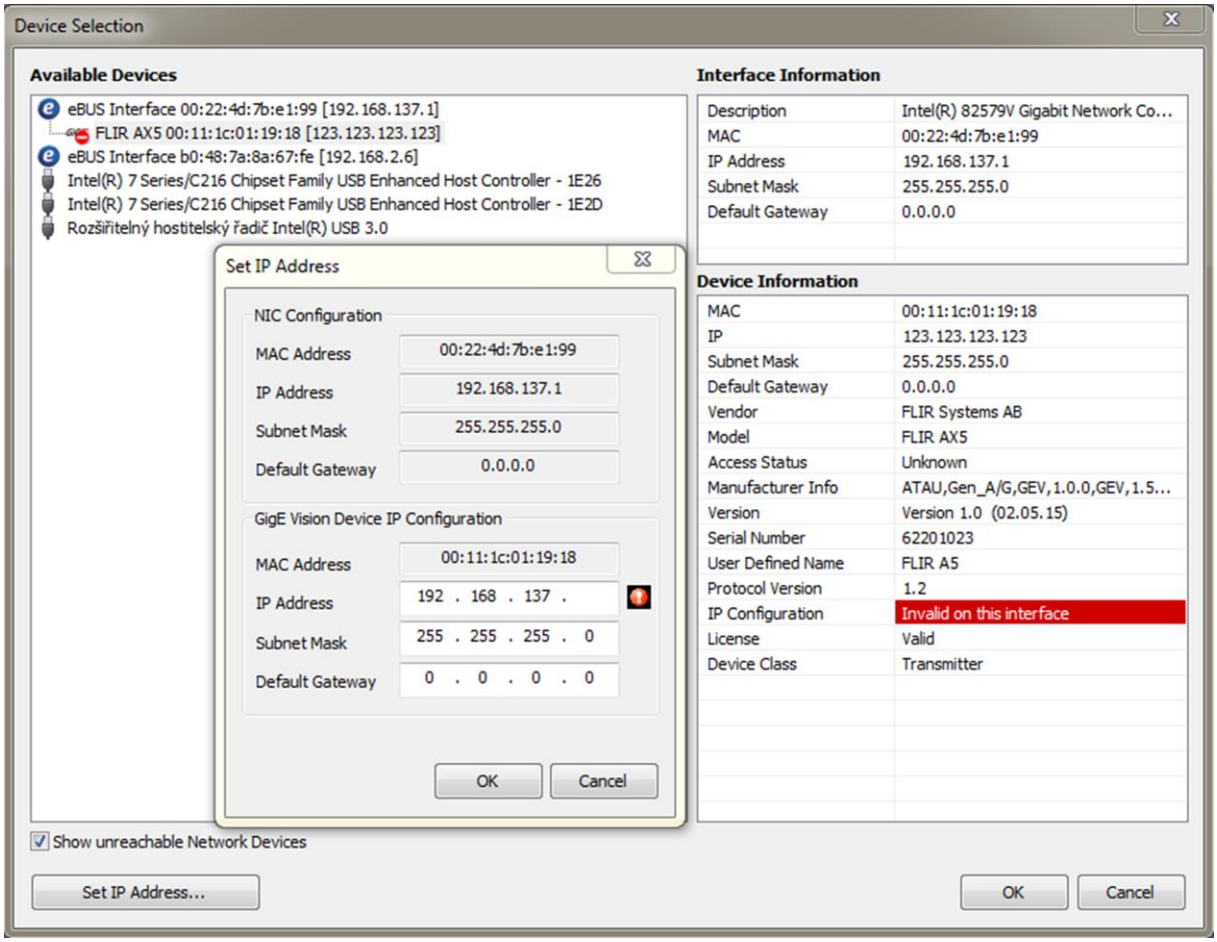
Device selection

Now, you see available devices, select one and click *Ok* to perform connection.



Unreachable camera

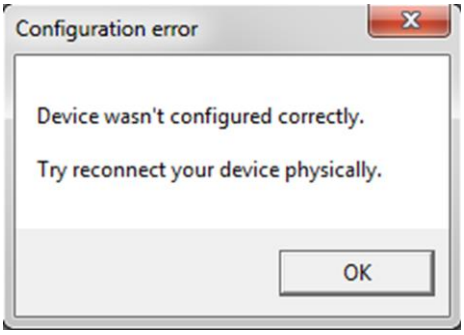
Sometimes camera has incorrect network setup and it doesn't show up, so check the *Show unreachable Network devices* and your camera should show, select it and click *Set IP Address* and than set correct IP address corresponding to your network configuration.



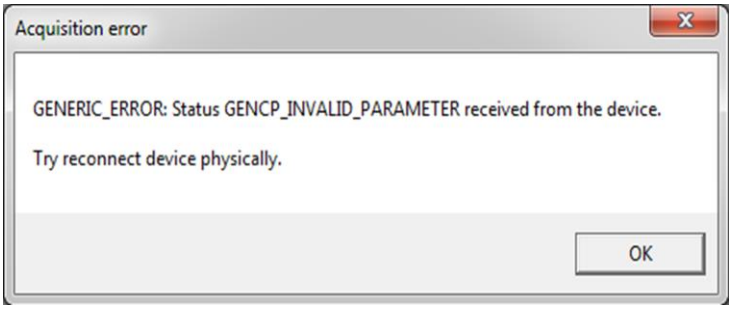
Incorrect network configuration

Connection/Configuration error

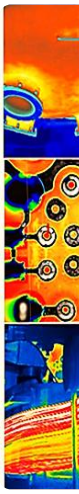
In some cases, one of following error can occur. Try plug off and plug power of you device. When the errors persist, try reboot your computer. In case of USB3 device, if errors persist, try update your BIOS and/or USB3 controller drivers.



Internal serial port unreachable



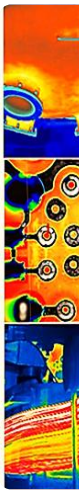
Acquisition error - device connected and configured, but image cannot be acquired



General device informations

Now, you camera is connected and several informations are shown below.

- **IP Address**
  - network address of your camera device
  - GigE devices only
- **MAC address**
  - unique identifier assigned to network interfaces
  - GigE devices only
- **USB3 module serial**
  - unique identifier assigned to USB3 devices – GUID
  - USB3 devices only
- **Camera manufacturer**
  - Camera vendor
  - For Tau2 device – Flir Systems AB
- **USB3/GigE module manufacturer**
  - USB3/GigE module vendor
  - Tau2 devices only
- **Model**
  - Camera model
  - Tau2 336, AX5 etc...
- **Name**
  - User -defined camera name - „Nickname“
  - Can be changed – Device control → UserName
  - Tau2 cameras – name of GigE/USB3 module only



Acquisition

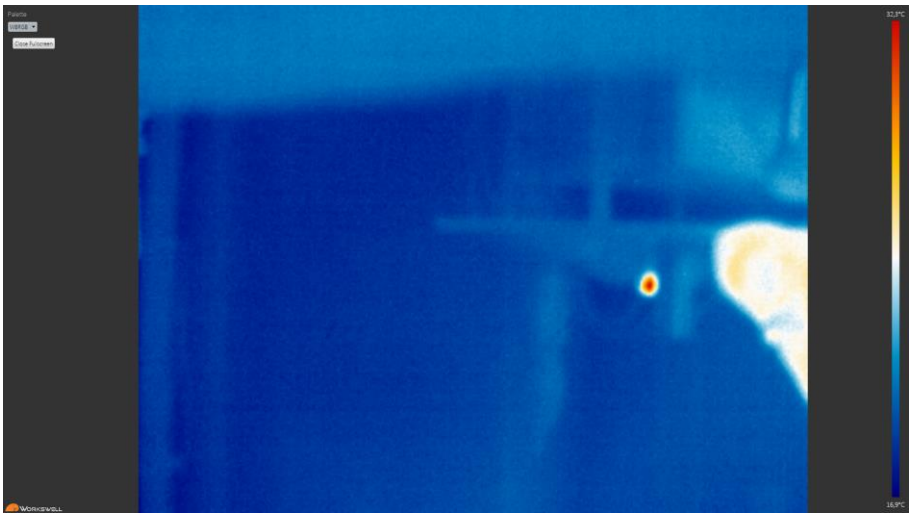
You can control video streaming by simple click on Play/Pause button.

When the stream is paused, you can still measure, save or export last displayed image.

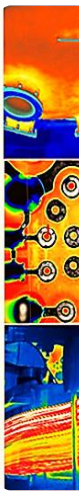
- **Framerate**
  - You can control image acquiring frequency from 1 – 60 frame/sec
  - Thermal cameras only

Image

- **Brightness & Contrast**
  - changes brightness and contrast of streamed image and palette
  - has effect on captured image as well
  - no effect on calculated temperatures
- **Palette**
  - shows data in selected color scale
  - assigned temperatures can be seen on right-sided temperature scale
- **Interpolation**
  - enable/disable image pixel interpolation
  - for device resolutions lower then displayed image only
- **Fullscreen**
  - switchs to full-screen mode
  - full-screen image with image related controls – palette
  - looks best on wide-screen displays
  - ends full-screen mode by clicking at *Close fullscreen* button



Fullscreen mode



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Parameters

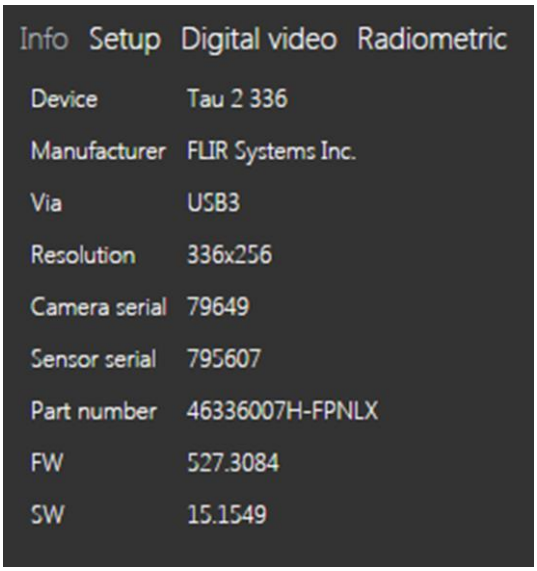
- **Communication control**
  - GigE/USB3 related communication parameters and informations
  - Preconfigured – no need to change
- **Device control**
  - USB3/GigE module device parameters and informations
  - eg. DeviceUserID – User-defined name of module
  - General settings - Pixel Format, Output, Resulution etc...
  - Non-Tau2 devices only
  - Preconfigurated for Tau2 cameras – no need to change
- **Image stream controlled**
  - Image stream informations
  - Preconfigured – no need to change

Camera settings

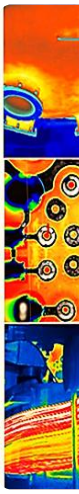
Tau2 based deviced cannot be currently controlled over standard GenICam device control parameters, so instead you can use following graphic interface on the right side of application.

Parameters are sorted to several categrories:

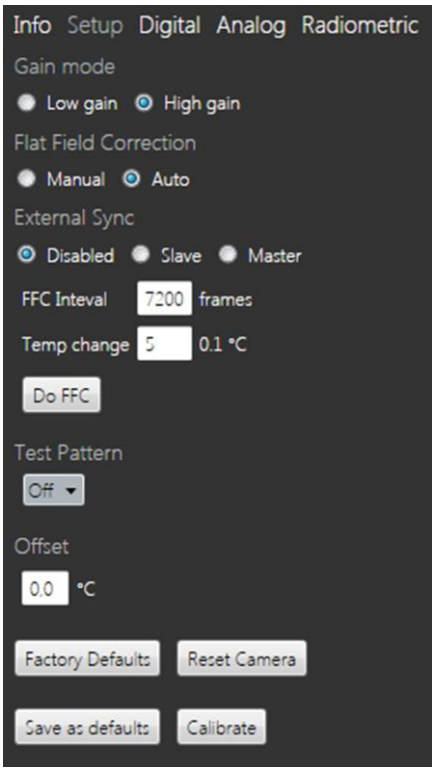
- **Informations**
  - Device informations – name, type, vendor, serial numbers etc...



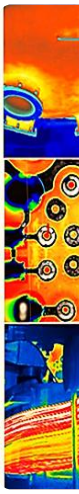
Device informations



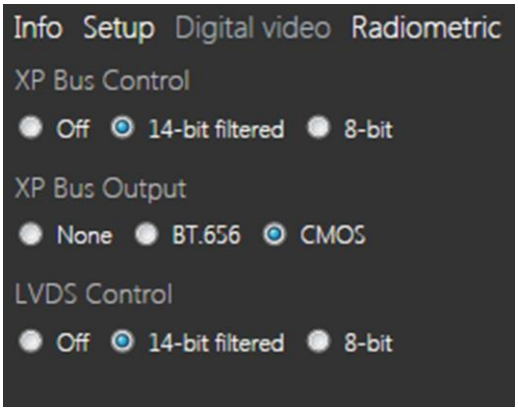
- **Setup**
  - **Gain mode**
    - Changes temperature ranges
    - **High gain**: from –40°C to +160°C
    - **Low gain**: from –40°C to +550°C
  - **External sync**
    - The Tau 2 core provides an external sync channel that can be used to synchronize frame start between two Tau cores, one configured as master and the other configured as slave.
    - **Disabled** – The core relies on internal timing.
    - **Master** – The core relies on internal timing to control its own frame start but also outputs a synchronization pulse on the external-sync channel.
    - **Slave** – the core synchronizes its frame start to a pulse received on the external-sync channel.
  - **FFC** – Flat Field Correction
    - also known as NUC – Non-Uniformity Corection
    - **Auto**: Let camera decide when execute, based on conditions below
      - Number of processed frames
      - Device sensor temperature change
    - **Manual**: Perform FFC manualy
      - Click on *Do FFC* button
  - **Test pattern**
    - Off – temperature data are transmitted.
    - Ramp – Test image.
  - **Offset**
    - Simple calibration.
    - Added to calculated temperatures.
  - **Restore defaults**
    - Restores default parameters.
    - See table 3-6 in Tau2 IDD document to see full list of affected parameters.
  - **Reset camera**
    - Performs reset/reboot of camera.
    - Device has to be physically reconnect to affect.



Device setup

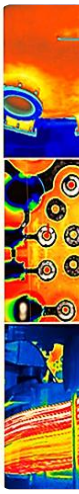


- **Digital video**

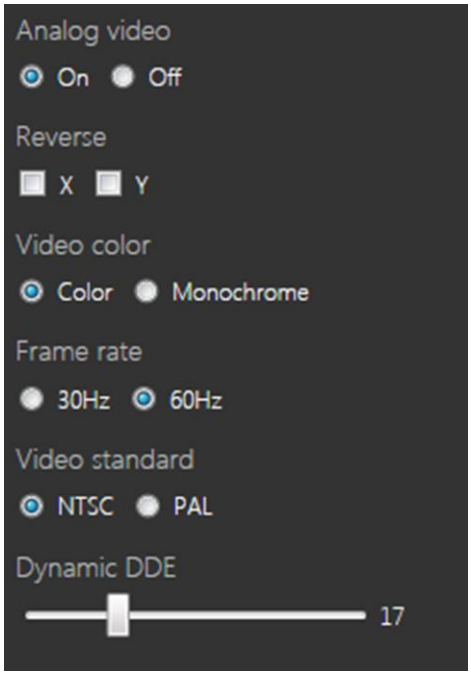


Digital video

  - You can change type and bit depth of digital output.
  - **XB Bus, 14bit CMOS** is recommended to correct temperature calculation.
- **Analog video**
  - **Setup**
    - **On/Off** Analog video
    - **Reverse** video
      - Upside down (**X**), Leftside right (**Y**)
      - Affects digital output
    - **Video color**
      - Color/Monochrome
    - **Frame rate**
      - doubles framerate – 25/50Hz, 30/30Hz
    - **Video standard**
      - NTSC/PAL
      - FFC should be executed afterward
    - **Dynamic DDE**
      - digital-data-enhancement algorithm which can be used to enhance image details and/or suppress fixed pattern noise
      - DDE parameters are computed automatically based on scene contents. DDE index (which supplants the spatial-threshold parameter used in the manual algorithm) is the only controlling parameter and ranges from 0 to 63, with higher values representing higher degrees of detail enhancement.
      - If no enhancement is desired, the value should be set to 17.
      - Values less than 17 soften the image and filter fixed pattern noise.
      - Values greater than 17 sharpen the details in the image.

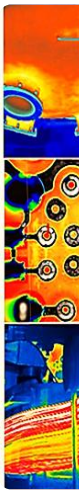


- Affects digital output

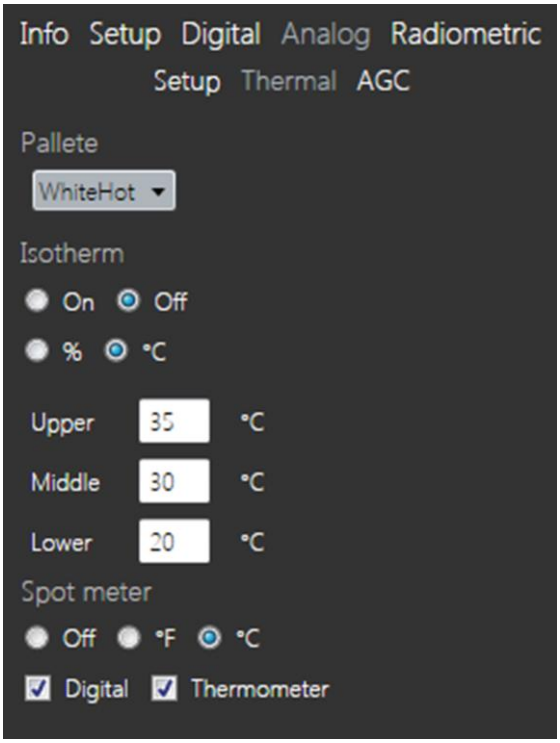


Analog video - Setup

- **Thermal**
  - **Palette**
    - Changes color palette
    - Colors depends on isotherm setup
  - **Isotherm**
    - Portions of the scene exceeding a user-selectable threshold are mapped to different portions of the palette.
    - Three user-specified thresholds are applicable to the isotherm mode.
    - Specified either in degrees Celsius(**°C**) or in percentage(**%**) of full-scale
    - **Upper** threshold above which pixels will be mapped to the top shades of the palette (224 to 255).
    - **Middle** threshold pixels with value between the middle and upper threshold are mapped to shades 176 to 223.
    - **Lower** threshold pixels with value between the lower and middle threshold are mapped to shades 128 to 175.
  - **Spot meter**
    - temperature-measurement capability via a spot meter in the central 4x4 area.
    - Accuracy of the spot meter is ±20 °C in high-gain state and the greater of ±20% or ±20C in low-gain state.
    - Can be shown as **Digital** numeric value and/or **thermometer**-style gauge.

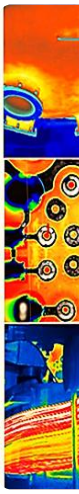


- The numeric indicator and gauge can be shown in degrees Celsius(**°C)** or Fahrenheit(**°F)**.

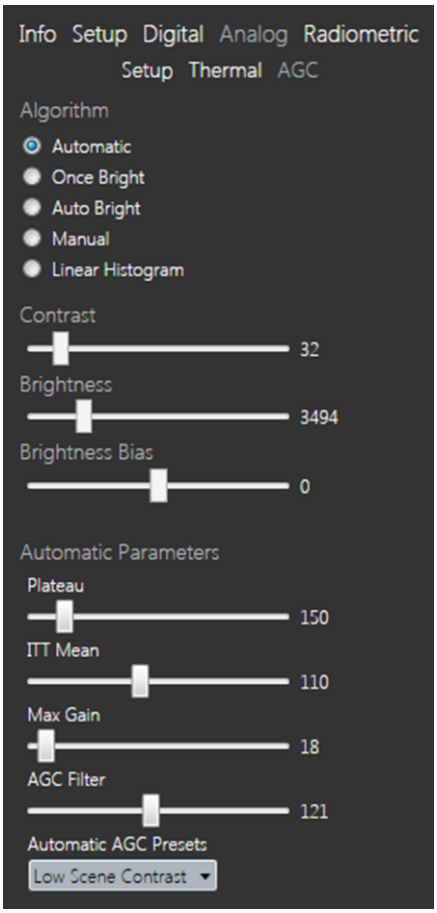


Analog video - Thermal

- **AGC**
  - The Tau 2 core provides multiple AGC algorithms used to transform 14-bit data to 8-bit.
  - See chapter **3.3.2.6** in Tau2 Product Specification
  - Not available in isotherm mode
  - **Algorithm**
    - **Automatic**
      - Automatic parameters adjustable
    - **Once Bright**
      - Contrast adjustable
    - **Auto Bright**
      - Contrast, Brightness Bias and AGC Filter adjustable
    - **Manual**
      - Contrast and Brightness adjustable
    - **Linear Histogram**
      - ITT Mean, Max Gain and AGC Filter adjustable



- **Contrast**
  - Image contrast
- **Brightness**
  - Image brightness
- **Brightness bias**
  - Once Bright mode only
- **Automatic parameters**
  - **Plateau**
    - When plateau value is set high, the algorithm approaches the behavior of classic histogram equalization – grayshades are distributed proportionally to the cumulative histogram, and more grayshades will be devoted to large areas of similar temperature in a given scene. On the other hand, when plateau value is set low, the algorithm behaves more like a linear AGC algorithm – there is little "compression" in the resulting 8-bit histogram.



Analog video - AGC

ITT Mean

- The ITT Midpoint can be used to shift the 8-bit histogram darker or brighter. The nominal value is 128. A lower value causes a darker image. A darker image can help improve the perceived contrast, but it is important to note that more of the displayed image may be railed (8bit value = 0 or 255) by moving the midpoint away from 128.

Max Gain

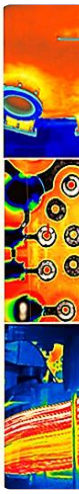
- For scenes with high dynamic range (that is, wide 14-bit histogram), the maximum gain parameter has little effect. For a very bland scene, on the other hand, it can significantly affect the contrast of the resulting image.

AGC Filter

- The IIR filter is used to adjust how quickly the AGC algorithm reacts to a change in scene or parameter value.

Automatic AGC Presets

- These presets apply only to the Automatic AGC algorithm and set predefined values that are stored in the GUI for Plateau Value, ITT Mean, and Max Gain. These presets have been empirically determined for different scenarios. These settings are intended to be used as guidelines and are not guaranteed to be the optimum values for any particular scenario. It is recommended to fine-tune settings for preference and scene conditions.



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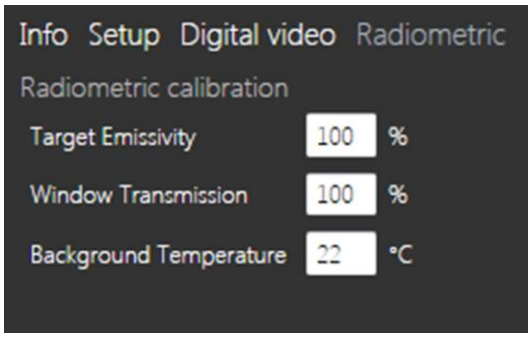
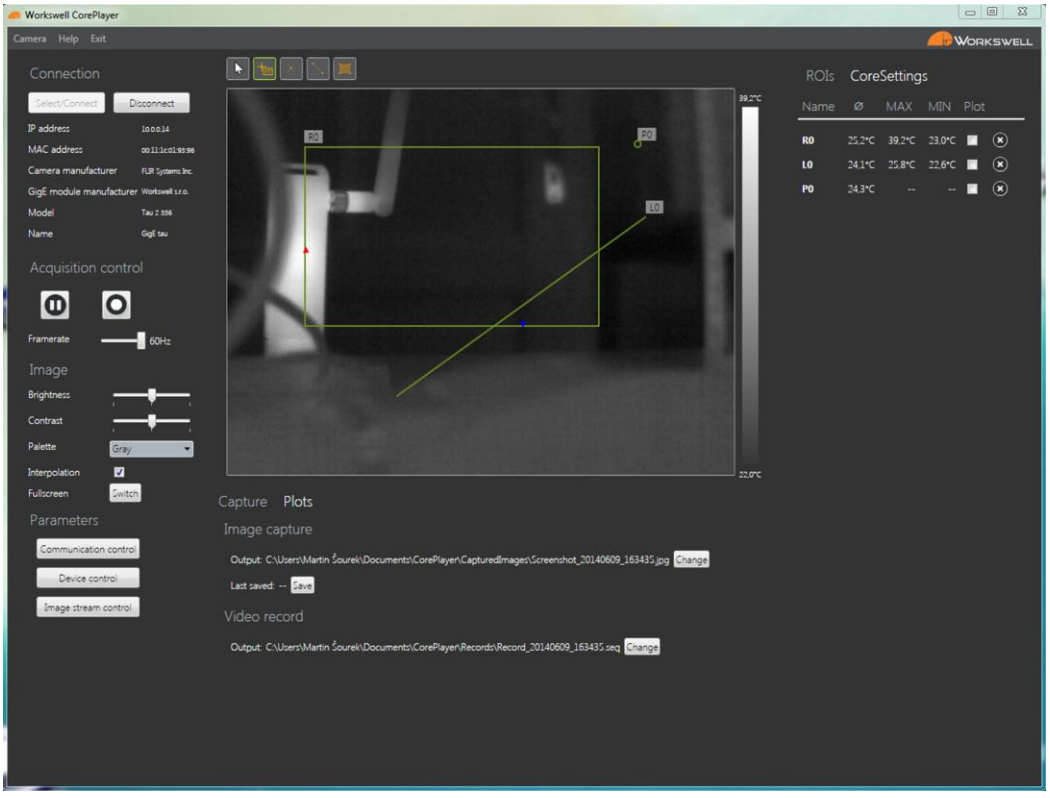
- **Radiometric**
  - Radiometric parameters used for temperature calculation.
  - Used for both software and device (central spot) temperature calculation.



Radiometric parameters

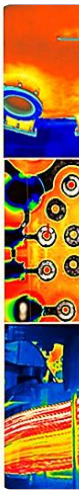


Acquisition running

Video stream

Data locating

- Shows minimum and maximum data values and theirs assign to palette
- Thermal cameras only

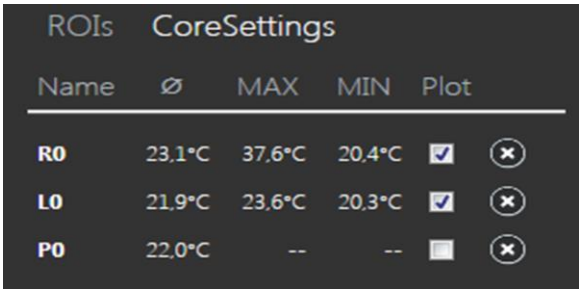


Measuring tools – ROIs (Regions Of Interest)

- Thermal cameras only

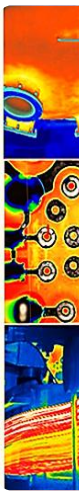
Measuring tools

- **Toolbar**
  - **Select ROI**
    - You can resize/move selected ROI by draging on it's corner (*line & rectangle*) or ROI itself (*point*)**.**
  - **Pixel measuring tool**
    - When you point cursor on image, popup with pointed pixel data and temperature (if available) values is shown.
  - **Point**
    - click to image to place the point
  - **Line**
    - click&drag to place the line
  - **Rectangle**
    - click&drag to place the rectangle
- **ROIs list**

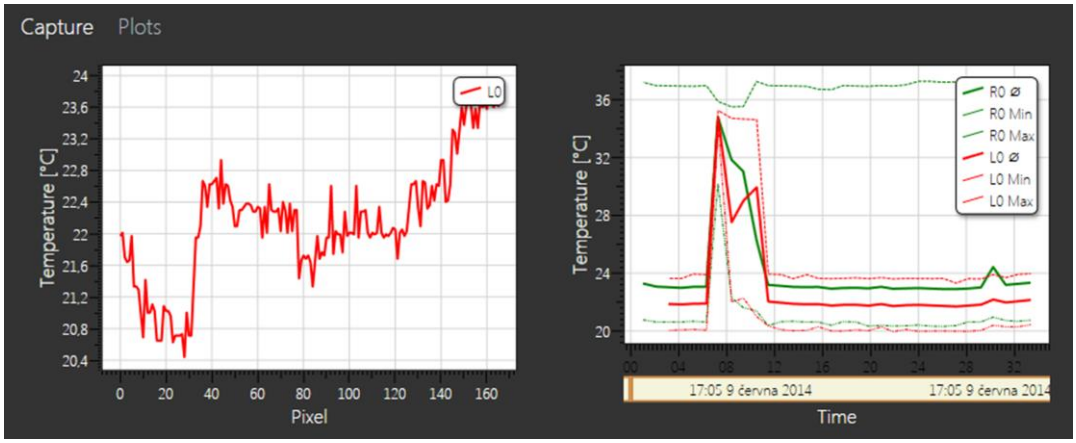


Current ROIs list

- When you add new ROI, it will be shown here
- Average, maximum and minimum temperature of ROI (except point) is displayed
- You can delete it by clicking on "*cross*" button.
- Enable plotting by checking *Plot* checkbox.

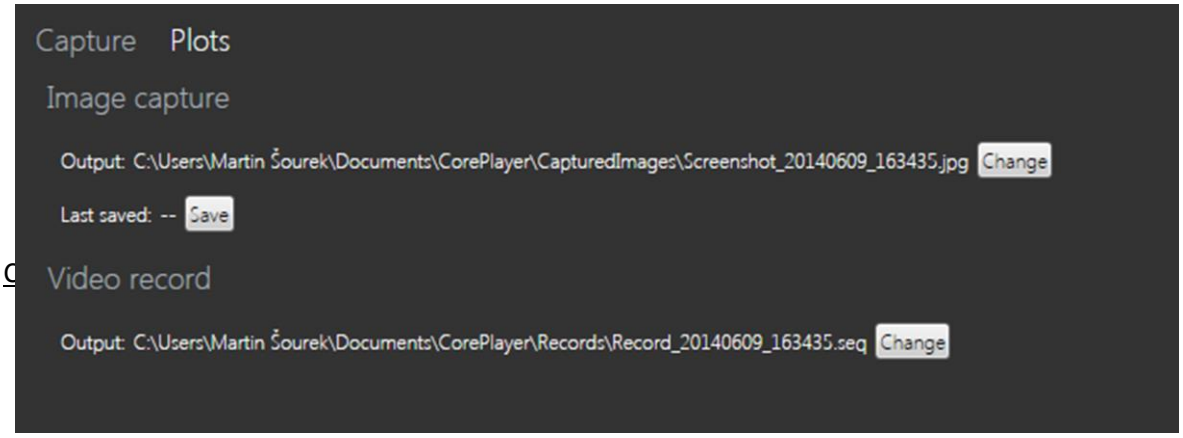


- **Plots**



Plots – Thermal Profile & Time profile

- ROI plotting is enabled by checking Plot checkbox in ROIs List
- **Thermal Profile**
  - Line ROIs only
  - Temperatures of pixels on the line

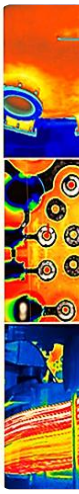


Capture

- **Image capture**

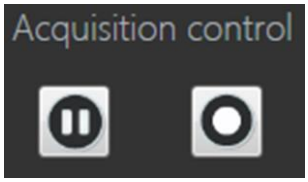
  Images can be saved to followed formats:

  - **PNG**
    - lossless data compression
    - temperature scale inluded (thermal cameras only)

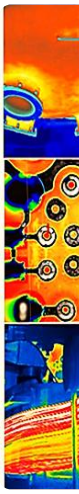


- **Radiometric JPEG**
  - native FLIR image format
  - standard JPEG with radiometric data included
  - image can be shown in every common image viewer
  - full radiometric support in FLIR Tools
- **CSV**
  - comma separated temperature matrix

- **Video record**
  - Video stream will be saved as Flir Radiometric video (*.seq file)
  - Record/Stop is provided by clicking on the *Record* button



Record button(right)



CoreLibrary

Overview

This library provides basic support of Flir Tau2 cameras. Because these cameras don't support setup over standard GEV parameters, they have to be set via internal serial communication.

Library with full documentation, samples etc. is available through *CorePlayer → Menu → CoreLibrary Documentation* or *%Documents%/CorePlayer/CoreLibrarySRC*

Characteristics

Library is written in both C# and C++ and tested in Windows and (supported) Linux systems as well.

Library is based on Pleora eBUS SDK, which is bundled to CorePlayer and documented

- *Start → Pleora Technologies Inc → eBUS SDK*

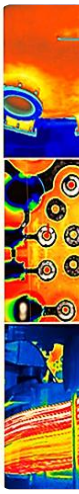
Requirements

- **Pleora eBUS SDK** 4.0.3
- Visual Studio 201x – C# version
- Visual Studio, NetBeans or any suitable IDE – C++ version

Sample use

See related documentation! Only prerequisition is *connected PvDevice object*. *SetDefault* method sets both Pleoras videograbber and FLIR Core to correct default parameters.

Every parameter can be changed by related *Property*(C#) or *Getter/Setter*(C++)



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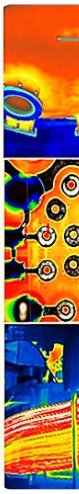
Conection and Setup Example

```
//IP address, MAC address or GUID of camera.

PvDevice device = PvDevice.CreateAndConnect("192.168.1.25");

//For Tau2 cameras the serial port should be always Bulk0

CameraSerialSettings settings = new CameraSerialSettings(mDevice,
PvDeviceSerial.Bulk0);

//Sets default settings (serial link,14b out...). Should be called before
setting up any parameters above

settings.SetDefault();

//now, we can change parameters

settings.GainMode = GainModes.Low;

//execute some action like FFC/NUC

settings.DoFFC();

//or read up something

string manufacturer = settings.Manufacturer;
```

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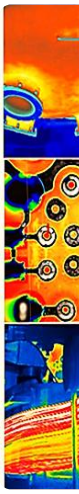
Data acquisition

See Pleora eBUS manual first to correct setup of PvDisplayThread, PvPipeline, etc...

This is not a standalone working code!

```
PvDisplayThread DisplayThread = new PvDisplayThread();
//set hook to new available frame
DisplayThread.OnBufferDisplay += new OnBufferDisplay(OnBufferDisplay);
private void OnBufferDisplay(PvDisplayThread aDisplayThread, PvBuffer aBuffer)
{
 PvImage ImageInfo = aBuffer.Image;
 uint pixelCount = ImageInfo.ImageSize / 2;//14b pixels are mapped to 2 bytes
 float [] Temperatures = new float[pixelCount];
 short[] RAWData = null;
 IntPtr bufferPtr;
 unsafe
 {
//there are other ways, how to do it, even without unsafe - see eBUS docs.
   bufferPtr = new IntPtr(ImageInfo.DataPointer);
 }
 if (bufferPtr != IntPtr.Zero)
 {
  // Allocate byte array that can contain the copy of data
  RAWData = new short[pixelCount];
  // Do the copying
  System.Runtime.InteropServices.Marshal.Copy(bufferPtr, RAWData, 0, (int)pixelCount);
  for (int i = 0; i < pixelCount; i++)
  {
    Temperatures[i] = Raw2Temperatures(RAWData[i]);
  }
 }
}
```

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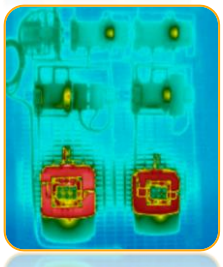

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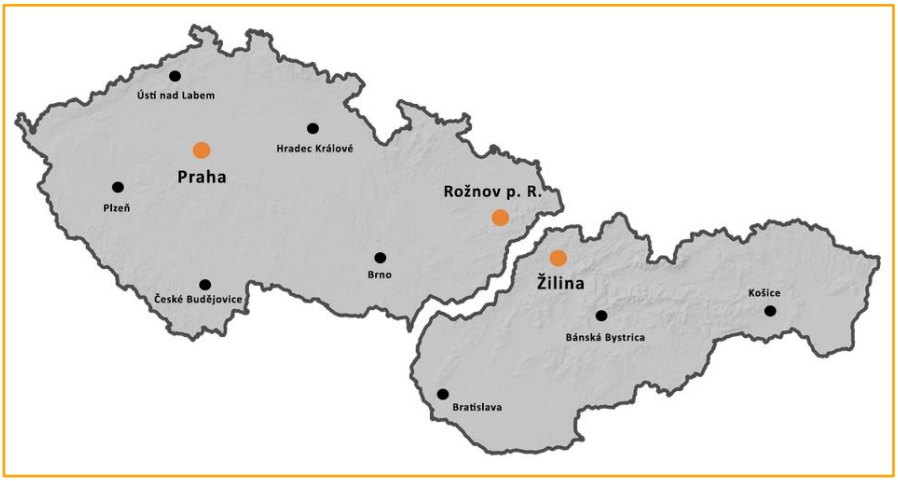

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CorePlayer software Manual